

THE MINERAL INDUSTRY OF PORTUGAL

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Portugal, on the Iberian peninsula, is one of the most mineralized areas of Western Europe and is geologically very complex. The mineral industry of Portugal is modest by world standards; however, its growth rate during the past few years has made minerals one of the country's dynamic industrial sectors. The country's mineral industry has undergone important changes with the discovery and development of the rich copper and tin deposits of Sociedade Minera de Neves-Corvo S.A. (Somincor) at Neves-Corvo. When the mine reached full production in 1991, there was a major increase in European copper and tin production.

The new Government restarted the country's privatization program and was proceeding with legislation that would privatize many public companies. The privatization issue was part of a broader program to reduce the role of the state and to restructure the Portuguese economy to one that is more market-driven.

Of interest to the mineral industry is the privatization of the mining conglomerate Empresa de Desenvolvimento Mineiro (EDM), which was scheduled for 1997-98. EDM is a holding company for state-owned interests in a number of mining concerns, including Somincor. It also has controlling interest in Pirites Alentajanas and Empresa Nacional de Uranio.

Somincor's Neves-Corvo Mine and the Panasqueira tungsten mine of Beralt Tin and Wolfram (Portugal) Ltd. were the two major operations in the metal mining sector. Pirites Alentajanas S.A.R.L. was the largest producer of pyrite; Siderurgia Nacional S.A.R.L. (SN) produced iron and steel. Cimentos de Portugal, S.A. (CIMPOR), an important producer of cement, was one of the companies included in the Government's privatization plans. With the exception of copper, ferroalloys, dimension stone, tin, and tungsten, which were of international importance, production of other minerals and related materials had only domestic significance. (*See table 1.*)

Most of the large mineral resource companies were owned or controlled by the Government, although there were some privately owned operations. About 32,000 people were employed by the mineral industry, including mining and processing. (*See table 2.*)

Somincor was 51% Government-owned through EDM. The minority partner was Rio Tinto Ltd., (formerly RTZ Corp.), a United Kingdom company that owns 49% of the joint venture. The mine was designed to produce 1.3 million metric tons per year (Mt/yr) of raw ore to yield 500,000 metric tons per year (t/yr) of concentrate averaging 26% copper content. The estimated life of the mine, based on estimated proven reserves, was 20 years. (Richards, Carvalho, and Sides, 1991).

The Neves-Corvo complex consisted of four proven ore bodies: Graca, averaging 10% copper; Corvo, ranging from 7% to 10% copper; Neves, averaging 1% copper; and Zambujal, a complex sulfide ore of copper, lead, and zinc. Zinc was also associated with the other three deposits, averaging 10% in the Graca ore body. Recovery of tin-in-concentrate has stabilized at Neves-Corvo at around 5,000 t/yr. As Neves-Corvo is primarily a copper mining operation, Somincor considers tin more as a byproduct.

Gold exploration activities were continuing in the Jales-Tres Minas gold district by the joint venture of Soc. des Mines du Bourneix (SMB), a wholly owned subsidiary of Compagnie Générale des Matières Nucléaires (COGEMA) of France, and EDM. The area includes the ancient Jales Mine and is located 150 kilometers (km) east of Oporto. SMB is a 70% majority partner in the project. Jales-Tres Minas is probably the most important gold district in Portugal.

Hydrothermal auriferous quartz veins occur along faults cutting middle to late Paleozoic peraluminous granites and Paleozoic graphite schist, micaschists, quartzites, and greywacke. The subvertical veins strike NNE to NE and WSW, may reach 2.5 km long and range in width from a few centimeters to a meter (m). Gold and electrum (naturally occurring gold-silver alloy) occur within the quartz and the sulfides, mainly arsenopyrite, pyrrhotite, sphalerite, chalcopyrite, and galena. In the core of the vein, the average gold grade was 37 grams per ton (g/t) of gold per ton of ore, but was reduced to 11 g/t over a 1 m width. Five paragenetic stages with distinct alteration features have been identified. At the end of its operation, the Jales Mine had produced over 25 metric tons (t) of gold and over 100 t of silver and reached a depth of 630 m. (Neiva and Silva, 1989).

The Portuguese iron and steel operation was nationalized in 1975 to function as a public entity incorporated as Siderurgia Nacional Empresa de Productos Planos (SN-Planos). The Government changed SN-Planos into a public, limited company as a major step toward privatization.

Beralt Tin and Wolfram (Portugal) Ltd. was the only producer of tungsten in 1996. Beralt was proceeding with development work at the Panasqueira Mine at Barroca Grande to improve efficiency and increase the life of the mine. Most of the work was directed toward the final treatment of concentrates and preparations for the mining of new areas of Level 3. The treatment plant for concentrates was moved to the main zone of operation and modernized to increase capacity and improve efficiency. Beralt also had a small production of byproduct copper and tin concentrates.

The industrial minerals sector was a modern and efficient producer of a variety of materials, most notably ceramics and dimension stone. The dimension stone industry continued as a very important segment of the mining industry in terms of value and trade. (See tables 3 and 4.)

Marble was the most valuable of the stone products and accounted for about 68% of stone production. The main area for marble mining continued to be the District of Evora. There was potential for increased production of granite, marble, and slate.

Demand for cement continued as the building and construction industry maintained its level of activity. This situation was expected to continue with preparations for EXPO 98 in Lisbon and the substantial volume of work in coming years to develop Portugal's infrastructure.

Coal accounted for about 4% of total energy consumption. Most coal was imported although there are some domestic reserves. Empresa Carbonifera de Douro S.A.'s Germunde Mine at Castello de Paiva was to be closed because of high production costs and difficult mining conditions. Coal demand was growing because the electricity sector was switching from oil to coal. There were no natural gas reserves and no nuclear powerplants in Portugal. Hydropower accounted for about 45% of electricity generation. The Government sought to diversify its energy sources and increase electrical power capacity to meet consumption growth.

The Administracao do Porto de Sines initiated a program to build a terminal at the Port of Sines principally for steam coal imports by Electricidade de Portugal for electricity generation. The two major cement producers, Cimpor and Secil, also used coal as a major fuel source.

The transportation network included 3,613 km of railroads, most of which was operated by the state-owned Portuguese Railroad Co. (CPR). Most of the trackage was single-track,

1.665-m gauge, of which about 15% is electrified. CPR was planning to match the European gauge width of 1.433-m, on a number of key routes throughout the country. It was expected this would be done by adding a track to the existing lines.

The Government was planning to invest about \$22.4 billion¹ in infrastructure improvements during the next few years. The main thrust would be the modernization of the country's ports. Major seaports were Lisbon, Porto, and Sines. These ports were considered very important in a country where the main movement of goods was by sea. Other areas to be improved included the highways and bridges of the national motorway network. Portugal had about 74,000 km of usable roadways, of which 84% was paved.

The present structure of the mineral industry could change in the near future because of significant mining exploration in progress by several foreign companies. Copper, gold, kaolin, lead, lithium, pyrites, and tin were some of the minerals targeted for exploration. The Iberian Pyrite Belt, which extends from the southwest coast of Portugal near Setubal to the Guadalquivir River near Seville, Spain, was a prime area for exploration activity.

References Cited

- Neiva, A.M., Neiva, J. M., and Silva, M.M., 1989, Geochemistry of gold quartz vein walls from Jales (Northern Portugal), Abstracts 2: International Geological Congress, 28th, Washington, D.C., 1989, p. 504.
- Richards, D., Carvalho, P., and Sides, E., 1991, Geology and reserves of complex sulphides at Neves-Corvo, Symposium: Los Sulfuros Complejos del Suroeste de España, Sevilla, 1991, p. 12.

¹Where necessary, values have been converted from the Portugal escudos (Esc) to U.S. dollars at the rate of Esc153.64=US\$1.00.

TABLE 1
PORTUGAL: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1992	1993	1994	1995	1996 e/
METALS					
Arsenic, white e/	150	150	125	125	100
Beryl concentrate, gross weight e/	4	4	5	5	5
Copper, mine output:					
Cu content	152,311	153,797	133,629	134,181	109,900
Metal, smelter, secondary e/	1,000	1,000	--	--	--
Gold, mine output, Au content e/ kilograms	89	--	--	--	--
Iron and steel:					
Iron ore and concentrate:					
Gross weight, manganiferous	14,545 r/	16,175 r/	14,330	14,535 r/	18,620 3/
Fe content, manganiferous	5,365	6,114	5,409 r/	5,417 r/	6,890
Metal:					
Pig iron thousand tons	402	398	415	411 r/	418
Crude steel do.	769	775	749	829 r/	875
Lead, refined, secondary e/	7,400	8,300	13,000 r/	13,000 r/	12,000
Manganese, Mn content of iron ore e/	500	500	500	500	500
Silver, mine output, Ag content kilograms	39,454	36,000	31,800	38,600 r/	34,000
Tin:					
Mine output, Sn content	3,011	5,334	4,332	4,627 r/	4,800
Metal, primary and secondary e/	100 r/	100 r/	100 r/	100 r/	100
Titanium, concentrates: e/					
Gross weight	30	20	20	--	--
Content of TiO2	10	5	5	--	--
Tungsten, mine output, W content	1,126	768	60	1,511	1,343 3/
Uranium concentrate, U3O8	29	33	28	22 r/	17 3/
Zinc, smelter, primary e/	2,200	3,500 r/	4,200 r/	4,200 r/	4,800
INDUSTRIAL MINERALS					
Barite e/	378	-- r/	50	-- r/	--
Cement, hydraulic thousand tons	7,638	7,600	7,500	7,500	7,200
Clays:					
Kaolin 2/	194,090 r/	178,285 r/	181,933	180,000 r/	175,000
Refractory e/	300,000	300,000	431,967 3/	300,000	300,000
Diatomite e/	1,850	1,860	2,150	1,780 r/	2,000
Feldspar	99,645	90,547	92,440	106,559 r/	100,000
Gypsum and anhydrite	416,824	458,112	450,000 e/	450,000 e/	450,000
Lime, hydrated and quicklime e/	200,000	200,000	200,000	200,000	200,000
Lithium minerals, lepidolite	15,904	13,289	11,352	8,740	10,750 3/
Nitrogen, N content of ammonia e/	100,000	91,000	100,000	100,000	100,000
Pyrite and pyrrhotite (including cuprous), gross weight	14,000	14,000	14,000	12,000	10,000
Salt:					
Rock	592,485	524,540	519,432	544,647	609,639
Marine e/	125,000	125,000	125,000	--	--
Total	717,485	649,540	644,432	544,647	609,639 3/
Sand e/	5,000	5,000	5,000	5,000	5,000
Sodium compounds, n.e.s.: e/					
Soda ash	150,000	150,000	150,000	150,000	150,000
Sulfate	50,000	50,000	50,000	50,000	50,000
Stone: e/					
Basalt thousand tons	100	100	530	100	100
Calcareous: do.					
Dolomite do.	150	150	471 3/	150	150
Limestone, marl, calcite do.	20,000	15,000	33,134 3/	15,000	15,000
Marble do.	900	939	935 3/	800	800
Diorite do.	1,000	1,000	1,029 3/	1,000	1,000
Gabbro do.	2,500	1,000	132 3/	100	100

See footnotes at end of table.

TABLE 1--Continued
PORTUGAL: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1992	1993	1994	1995	1996 e/	
INDUSTRIAL MINERALS--Continued						
Stone e/--Continued:						
Granite	thousand tons	12,000	8,500	17,360 3/	10,000	10,000
Graywacke	do.	20	20	138	20	20
Ophite	do.	50	50	110	50	50
Quartz	do.	8	9	14	28 r/	25
Quartzite	do.	500	500	526	500	500
Schist	do.	100	100	273	100	100
Slate	do.	50	61	40	30	30
Syenite	do.	30	30	58	25	25
Sulfur: e/						
Content of pyrites		5,000	5,000	5,000	5,000	5,000
Byproduct, all sources		4,000	4,000	4,000	4,000	4,000
Total		9,000	9,000	9,000	9,000	9,000
Talc		9,166	9,054	8,367	8,400	8,400
MINERAL FUELS AND RELATED MATERIALS						
Coal, anthracite e/	thousand tons	221	216	148	140	140
Coke, metallurgical e/	do.	150	150	150	150	150
Gas, manufactured e/	million cubic meters	130	125	125	125	125
Petroleum refinery products: e/						
Liquefied petroleum gas	thousand 42-gallon barrels	4,600	4,500	4,600	4,600	4,600
Gasoline	do.	12,000	14,000	15,000	15,000	15,000
Jet fuel	do.	5,200	5,000	5,000	5,000	5,000
Kerosene	do.	230	225	225	225	225
Distillate fuel oil	do.	21,000	20,000	20,000	20,000	20,000
Residual fuel oil	do.	20,000	20,000	20,000	20,000	20,000
All other products	do.	8,600	8,800	9,000	9,000	9,000
Refinery fuel and losses	do.	3,400	3,500	3,500	3,500	3,500
Total	do.	75,030	76,025	77,325	77,325	77,325

e/ Estimated. r/ Revised.

1/ Table includes data available through Apr. 1997.

2/ Includes washed and unwashed kaolin.

3/ Reported figure.

TABLE 2
PORTUGAL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1996

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of facilities	Annual capacity	
Cement	Cimentos de Portugal S.A. (Cimpor) (Government, 100%)	10 plants, various locations	6,000	
Coal	Empresa Carbonifera de Duro S.A.R.L. (ECD) (Government, 100%)	Germunde Mine at Castello de Pavia	150	
Copper	Sociedade Mineira de Neves-Corvo S.A. (Somincor) (Government, 51%; Rio Tinto Ltd., 49%)	Neves-Corvo Mine near Castro Verde	500	
Diatomite	Sociedade Anglo-Portuguesa de Diatomite Lda.	Mines at Obidos and Rolica	5	
Feldspar	A.J. da Fonseca Lda.	Seixigal Quarry, Chaves	10	
Ferroalloys	Electrometalurgia S.A.R.L. (Eurominas)	Plant at Setubal	100	
Petroleum, refined	barrels per day	Petroleos de Portugal (Petrogal) (Government 100%)	Refineries at Lisbon, Porto, and Sines	300,000
Pyrite	Pirites Alentejanas S.A.R.L. (Eurominas)	Plant at Setubal	100	
Steel, crude	Siderurgia Nacional S.A.R.L. (SN) (Government 100%)	Ironworks and steelworks at Seixal and Maia	1,000	
Tin	Sociedade Mineira de Neves-Corvo S.A. (Somincor) (Government 51%, Rio Tinto Ltd., 49%)	Neves-Corvo Mine near Castro Verde	5	
Tungsten	Beralta Tin and Wolfram (Portugal) Ltd. (Minorco S.A., 91%; Government 9%)	Mine and plant at Panasqueira	1,600	
Uranium	tons	Empresa Nacional de Uranio (ENU)	Mines and plant at Guargia	170
Zinc, refined	Quimigal E.P. (Government 100%)	Electrolytic plant at Barreiro	11	

TABLE 3
PORTUGAL: EXPORTS OF NATURAL STONE

Commodity	1993		1994		1995	
	Tons	Thousands	Tons	Thousands	Tons	Thousands
Granite	115,621	\$25,098	137,440	\$28,283	166,956	\$33,205
Marble	254,474	109,517	285,600	124,449	271,210	115,244
Paving blocks and kerbs	524,966	40,785	499,119	38,888	490,501	39,078
Slate	9,178	365	9,667	4,007	11,766	5,082
Total	904,248	175,765	931,826	195,627	940,343	192,609

Source: Roc Maquina, Mar., 1997, No. 24, p. 88, Bilbao, Spain.

TABLE 4
PORTUGAL: MAIN EXPORT MARKETS FOR NATURAL STONE

Country	1993		1994		1995	
	Thousands	Percent	Thousands	Percent	Thousands	Percent
Germany	\$40,149	22.42	\$40,554	20.62	\$38,069	19.78
Spain	18,245	10.19	17,680	8.99	19,714	10.24
Saudi Arabia	17,309	9.67	21,910	11.14	19,125	9.93
Italy	15,753	8.80	19,844	10.09	18,243	9.47
France	18,017	10.06	16,271	8.28	15,968	8.29
Others	69,583	38.86	80,368	40.88	81,462	42.29
Total	179,056	100.00	196,628	100.00	192,608	100.00

Source: Roc Maquina, Mar., 1997, No. 24, p. 88, Bilbao, Spain.